# Iowa's Water

As educators, we often ask questions of our students to help them learn about the world around them. A common question is, "What are the four components of habitat?" It's amazing how quickly some students will answer food, water, shelter, and space. Have you ever wondered how much they know about these? Let's take water. How much do they know about water? Where does it come from? How can it be polluted?

Students may know that all creatures need water to survive. (Without it we could live for just a few days.) They may also know that water is composed of three tiny atoms, one oxygen and two hydrogen, bonded together. Some may even know that Iowa receives 32 inches (over 2½ feet) of precipitation a year. But do students know about the quality of our water? Better yet, do they know about the history of water quality in Iowa?

## Iowa's History

Before Euro-American settlement, it is estimated Iowa had 28.6 million acres of prairie, 6.7 million acres of forest, and 4.5 million acres of wetlands. Approximately 22,000 miles of interior rivers and streams meandered through these wild areas. Pre-settlement Iowa was home to many species of wildlife including buffalo, elk, deer, bear, channel catfish, northern pike, passenger pigeons, smallmouth bass, and brook trout. The Native Americans who lived here were predominately descendents of the Woodland Culture (named by Euro-Americans). These people farmed, hunted, played, and died on the land we now call Iowa.

### Early Explorers

Early explorers were some of the first Euro-Americans to see Iowa as a diverse, pristine ecosystem. Bohumil Shimek, an early Iowan naturalist, described the pre-settlement forested ravines as having "…beautiful ferns, interspersed with pink and yellow ladies'-slippers and many other wild flowers, all in great profusion." Early explorers saw these ravines and other breathtaking beauties we can hardly imagine.

Many explorers followed rivers and streams as they made their way across Iowa. These explorers wrote of Iowa's rivers and streams in their journals. They described some rivers and streams as being "…relatively clear with a gravel bottom…" (Albert Lea, 1836). Some caught remarkable amounts of fish in the rivers, "…Captain Lewis went out the next day with his party and returned with 709 fish nearly 200 pike amongst them…" (Whitehouse, 1806).

#### *Marquette and Joliet*

Euro-American exploration began in 1673 when Father Marquette (a Jesuit priest from France) and Louis Joliet (a French-Canadian fur trader from Quebec) canoed from Fort St. Ignace on Lake Michigan, up the Fox River to the Grande Portage (now Portage, Wisconsin) where they entered the Wisconsin River. They and five other voyagers traveled down the Wisconsin River, entering the Mississippi River at Prairie du Chein, Wisconsin, in June of that same year. It is believed they are the first Europeans to visit Iowa, stepping ashore near the confluence of the Iowa and Mississippi Rivers.

Marquette and Joliet are credited as being some of the first Europeans to ever see the Mississippi River. As they entered the Mississippi they saw a large channel with backwaters, sloughs, and secondary channels. The river was full of life, from bluegill, bass, and catfish to countless birds, beaver, deer, and other wildlife using the river for food, water, or navigation routes. In some places the bottom of the river was paved in mussels, similar to the cobblestone streets Marquette and Joliet had seen in towns. In spring, the river flooded while in summer it was low, allowing many aquatic plants to flourish. The scene they saw must have been incredible. Father Marquette recorded the sights he saw and experiences he encountered in his journal.

At the confluence of the Arkansas and Mississippi Rivers, the group began their return journey up the Mississippi. The area south of this point was under Spanish occupation. Since Spain was France's rival they feared they would encounter trouble if they continued. The party traveled up the Mississippi and Illinois Rivers to Lake Michigan. Unfortunately, Joliet lost both copies of his journal when he tipped his boat in the La Cline Rapids near Montreal. He escaped the rapids, but an Indian boy did not. The only written accounts came from a short diary Marquette wrote during the voyage.

### *Lewis and Clark*

Lewis, Clark, and their crew of forty men (known as the Corps of Discovery) began their journey up the Missouri River on May 14, 1804. Their mission was four fold: 1. Find the Northwest Passage to the Pacific Ocean, 2. Create a good relationship with the Indians to increase trade, 3. Observe and record natural history and ethnology of the area, and 4. Look for resources for future settlers. All members of the Voyage of Discovery were required to keep a journal of their experiences, although not all have been recovered.

Thomas Jefferson selected his personal secretary, Meriwether Lewis, to organize this expedition. Lewis chose William Clark, his friend and former army commander, to share the responsibility of leading this remarkable adventure. Together, Captains Lewis and Clark would lead 40 men across terra incognita – the vast unknown land west of the Mandan Villages (located near present day Bismark, North Dakota).

While both men were comfortable in the wilderness and were excellent hunters, they were very different from each other. Lewis had a more formal education, trained in botany, zoology, geology, and celestial navigation. His personality is often referred to as being withdrawn, moody, and sometimes depressed. Clark was the cartographer for the journey and the better boatman. He is often described as having had a sunnier disposition than Lewis, and proved to have a more level head.

In the latter part of 1803, the crew built their quarters in an area across the river from St. Louis, which they named Camp Wood. Lewis spent much of the winter in St. Louis gathering supplies and making arrangements for their journey. On May 14, 1804, the crew started their journey up the Missouri. Their route would take them up the Missouri River (where they occasionally camped on Iowa shores), to the Mandan Indian village where they stayed the first winter, across the Bitterroot Mountains (in present day Idaho), and down the Snake and Columbia Rivers to the Pacific Ocean.

After reaching the Pacific in the late fall of 1805, they stayed at Fort Clatsop, on the estuary of the Columbia River. They began their journey home in late March of 1806. When the Corps of

Discovery passed the Bitterroot Mountains, they split up, exploring different rivers. Clark went down the Yellowstone while Lewis explored the Marias, both in present day Montana. They later met on the Missouri in present day North Dakota, and continued their journey back to civilization.

In 1806, Lewis, Clark, and the other members of the Corps of Discovery returned to St. Louis. Great celebrations were held in honor of their arrival. The Corps of Discovery traveled 8,000 miles to a land unknown, and (except for the loss of Sgt. Floyd near Sioux City, Iowa, from what is believed to be appendicitis) returned safely. With this journey, a broad path through the Rockies was mapped, the length of the Missouri River and much of the Columbia River were charted, relationships were established with many Indian Tribes, and information about 178 plants and 122 animals were added to the scientific world.

### *Zebulon Pike*

Approximately 132 years after Marquette and Joliet's journey, another explorer traveled the Mississippi. In August 9, 1805, General James Wilkinson assigned Lt. Zebulon Pike on a mission to discover the origin of the Mississippi River, look for potential military sites, and communicate with the native people living in the area. Pike led a crew of 20 men on a 70-foot keel boat (which he later traded for two barges at Prairie du Chein) up the Mississippi with little time to prepare for the journey.

He, like William Clark from the Corps of Discovery, was designated cartographer. However, there were many differences between Pike's expedition and the journey of the Corps of Discovery. Due to Pike's lack of training in the sciences, they did not look for new plants and animals. Pike had no interpreter of Indian languages and no physician. A watch, thermometer, and a theodolite (a device to determine latitude) composed his entire scientific equipment inventory.

On credit, Pike purchased over 155,000 acres where the Minnesota River empties into the Mississippi. Pike agreed to pay the Dakota (Sioux) Indians $200,000 for this land which would be used for a military reservation. Gen. Wilkinson did not agree with the location or the price, and refused to authorize the transaction. Later, army engineers found the land to be the best site for a military base on the Mississippi River. To the Dakota's dismay, the U.S. government paid a mere $2,000 for the land 13 years after the agreement. The post, later named Fort Snelling, was not constructed until 1819.

After the negotiation with the Dakota, the journey continued to run into problems. They ranged from backbreaking winter treks through frozen rivers and lakes and confrontations with British traders unwilling to lower British flags, to a sergeant giving away all of the stored meat, foodstuffs, and Pike's personal belongings at an American stockade.

After traveling close to 5,000 miles Pike returned to St. Louis on April 30, 1806, with disappointing results. He did not find the origins of the Mississippi, stop the illicit fur trade, bring any Indians back to meet with Gen. Wilkinson, nor did he find any new streams, lakes, or rivers. Purchasing the land for Fort Snelling and drawing attention of the activity of British traders in the U.S. (resulting in the Canadian/U.S. border) were his only successes. Despite the inadequate results of the journey, Gen. Wilkinson appointed him to go on another expedition to the southwestern United States, during which he reportedly named Pikes Peak in present day Colorado.

### *Stephen Kearny*

General Stephen Kearny, a soldier, builder, writer, and explorer, commanded the western army during the time of U.S. expansion. Kearny is often referred to as "The Father of U.S. Calvary." He led U.S. forces during the Mexican War where he left his name in many states including Arizona, California, Nebraska, Texas, and Wyoming. Before his military career blossomed, Kearny led explorations through Iowa.

In July of 1820, Kearny and his crew of four officers, 15 soldiers, four servants, and an Indian guide with his wife and baby, went on a government expedition to find a route from Council Bluffs to Camp Cold Water (later named Fort Snelling) in present day Minnesota. They followed the Boyer and Little Sioux Rivers and crossed the prairie pothole region to the northern post. Kearny reported seeing many land animals on his journey. Some of these animals include foxes, wolves, prairie chickens, rattlesnakes, elk, and a herd of 5,000 bison.

Kearny spent sixteen days traveling through Iowa on this expedition. For various reasons, he found this route to be impractical for larger military forces. Troops never followed the path again.

### *The Dragoons*

On March 2, 1833, President Andrew Jackson signed a bill creating a new armed force called the Dragoons. This armed force consisted of groups of uniformed soldiers which patrolled on horseback across the frontier. Some of the Dragoons' duties consisted of keeping peace between Indian tribes, keeping European poachers off Indian lands, building and maintaining paths/roads, and occasionally mapping and exploring uncharted areas of Iowa.

One of these explorations was organized to map the area between the Des Moines and Mississippi Rivers. In 1835, Lieutenant Colonel Stephen Kearny, Captain Nathan Boone (tenth child of Daniel Boone), Lieutenants Albert Lea (whom Albert Lea, Minnesota, is named for), and H.S. Tanner commanded three companies of approximately 170 men across "Indian Country." Lt. Lea (cartographer for the party) drew maps and kept a journal.

This large group of men traveled along many rivers in present day Iowa. Their journey started in the southeastern corner at Fort Des Moines (where Montrose now lies). The group followed the divide between the Des Moines and Skunk Rivers passing Hahawa Lake, present day Swan Lake, in Hamilton County. They crossed wetlands and prairies of north central Iowa. From here they traveled along the Cedar, Shellrock, and Upper Iowa Rivers in Iowa and the Root and Zumbro Rivers in Minnesota. The group of Dragoons saw the Mississippi and then started their journey home. This 1,100-mile trip took them approximately three months to complete.

Along the way, the Dragoons saw very little game, which they credited to the crowding of Indians on small tracts of land. Between hunting and the profit of fur trading many populations of game animals and fur bearers had been greatly reduced. They did notice, however, that every stream was well populated with fish.

The second company of Dragoons to explore Iowa was led by Captain James Allen in 1844. The primary purpose for this journey was to reach the source of the Des Moines River and explore modern day southwestern Minnesota and northwestern Iowa. They, like Albert Lea's group, traveled up the Des Moines River. However, this company left from a different Fort Des

Moines, one founded a year previous by Captain Allen. Present day Des Moines now sits in the location of this fort.

This company followed the Des Moines River until they reached its source. From here they traveled to the Minnesota River and then marched west to the Big Sioux River. While traveling on the Big Sioux River they marveled at a falls that "breaks through a wonderful formation of massive quartz (Sioux Quartzite) that crosses it perpendicularly, and over which the river falls 100 feet in 400 yards."

At the confluence of the Missouri and the Big Sioux, the men started back to Fort Des Moines across country. They noticed the rich prairie, timbered ravines, and the many streams as they crossed the virgin land.

This summer expedition covered 740 miles. Reports written by Kearny and Lea to the Adjunct General in Washington attracted many settlers to Iowa. Some historians consider it the most important exploration of Iowa.

### *The General Land Office (GLO)*

The U.S. General Land Office (GLO) was established in 1812 by the federal government to survey land in the central and western United States. Surveyed land was then "disposed of," sold, or given away. Settlers moving onto the frontier paid for the land. State, counties, schools, war veterans, railroads, and steamboat companies were given land. By surveying, the federal government could raise money and locate and legally describe the parcels purchased by the settlers.

The general survey of Iowa began in the fall of 1836 near the southeastern border, at the Mississippi River. Surveying parties often were composed of five to seven men: a deputy surveyor, two chainmen, a flagman, a marker (axeman), and sometimes one or two mound builders. Groups carried their own flags, shovels, axes, compasses, a 66-foot chain, and personal belongings until their contracts were completed. These men traveled across prairies, rivers, wetlands, and forests without paths or roads. It took 168 deputy surveyors twenty-three years to survey approximately 1,650 townships.

Each deputy surveyor kept field notes as he walked the land. The early field notes contained basic surveying measurements. Later field notes were more detailed and included descriptions of natural and cultural features of the survey lines. Geo(rge?) Stump, while crossing Sioux County, noted the Floyd River as being "…on average about 30 links wide and caused by be[a]ver dams to be about 30 inches deep gentle current good clear water low grassy banks in some places are lined with willow bu[s]hes runs in a gravel bed…." (These field notes currently are being used by Paul Anderson from Iowa State University to make digitized (computer) maps of Iowa's vegetation between 1832-1859.)

*If we traveled the routes of early explorers today, what would we find?*

## Iowa Today

Iowa has changed greatly from the time of early Euro-American settlement. According to the Iowa Association of Naturalists, we have lost 99.9% of the 30 million acres of prairie to agriculture, urban development, and transportation routes. More than 95% of the original 4.5 million acres of wetlands have been filled or drained to expand agriculture and development. Iowa also has lost 2/3 of the original 6.7 million acres of forests to early logging, fence posts, log buildings, and agriculture. In 1974, only 1.5 million acres of forests remained.

There is potential to reclaim some of our lost natural resources. According to the Iowa DNR, more than 606,000 acres of prairie *could be* restored through roadsides and private gardens. Some 100,000 acres of wetlands and surrounding uplands have been restored or are being reconstructed. In 2002, forest acres expanded to 2.5 million acres due to less grazing and more planting of trees.

### Water Quality

How does what happens on the land affect the quality of Iowa's water? Forests anchor soil, provide shade to keep waters cool for certain species of organisms to live in, and provide roots which create habitat for aquatic life. Prairie plants also hold soil in place, promote infiltration of water (decreasing run-off), and are the base of the prairie food chain. Wetlands are diverse habitats that hold water before slowly releasing it to rivers, streams, and lakes.

Water quality can be negatively influenced by human actions. Channelization (straightening) of streams and rivers to create more farmland and drain wet soils more quickly leads to increased soil erosion and loss of aquatic habitats. Fertilizers and chemicals applied to fields and lawns can end up in surface and groundwater. According to Iowa's State Hygienic Laboratory, of ten-thousand private water supply samples voluntarily submitted, 40 percent show unsafe bacterial contentand 15-20 percent exceed the maximum level for nitrate in drinking water (Iowa State University Extension, 1993).

While bacteria and chemicals contaminate underground wells, streams, lakes, and rivers, the leading pollutant in Iowa is silt (very fine soil). Sediment originates from erosion processes within a drainage area (watershed) of a river, marsh, or lake. Soil is carried to bodies of water by surface runoff, wind, or stream bank erosion. Soil erosion is a natural process but is accelerated greatly by human activity. Silt decreases the amount of light that enters the water, hence aquatic plants and algae are decreased. It adds to bottom sediments, clogs the gills of small aquatic animals such as insect larvae, smothers fish eggs, and interferes with sight feeders such as bass, which are unable to locate prey. Damage from erosion exceeds $54 million annually in Iowa.

Humans can have positive impacts on watersheds and water quality as well. Improving soil conservation in watersheds can reduce sediment entering rivers, streams, and lakes. Some examples of conservation farming practices that improve watersheds include buffer strips, grass waterways, terracing, rotational grazing, and minimum tillage. Routine maintenance of vehicles prevents pollutants such as antifreeze and oil from entering the environment through leaks. Disposing of litter and other wastes properly ensures aquatic animals will not be affected.

Research of aquatic systems and water quality has a positive impact on water quality as well. Research is performed by a variety of personnel, from DNR fisheries biologists, geologists, and environmental specialists to college professors and federal agencies, such as the Natural

Resources Conservation Service (NRCS), Fish and Wildlife Service, and Army Corps of Engineers.

Besides performing research, governmental agencies assist citizens in improving water quality. Many counties and towns have hazardous waste drop off sites and recycling centers. Soil and Water Conservation Districts, NRCS, and DNR/county foresters and wildlife and fisheries biologists assist landowners in reducing erosion through the creation of riparian buffers, wetlands, or grasslands. Buffer strips reduce soil loss, improve water quality, and stabilize stream banks. They also improve aesthetics and wildlife habitat. NRCS and DNR personnel help interested landowners evaluate their properties to determine whether they comply for the U.S. Department of Agriculture's Conservation Reserve Program (CRP).

Often biologists monitor resources to assess long-term changes in fish and wildlife populations that result from changes in habitat. The Long Term Resource Monitoring (LTRM) Program on the Mississippi River is an example. This program, authorized by Congress in 1987, was designed to address resource problems such as navigation impacts, sedimentation, water level fluctuations and quality, lack of aquatic vegetation, and reduced fish populations in addition to monitoring invertebrate populations and land cover/use.

Volunteer monitoring has been occurring for decades in Iowa. Early programs include "Save our Streams" and the "Iowa River's Project." In 1996, The DNR began the IOWATER volunteer water quality monitoring program with support of the Izaak Walton League, Iowa Environmental Council, Farm Bureau, Natural Resource Conservation Service (NRCS), and the University of Iowa's Hygienic Laboratory. Since its initiation, IOWATER has registered 1,000 sites for data collection.

## Other Materials

***Audiovisual Programs*** (contact your local AEA for availability):
Aging Lakes
A Freshwater Algal Boom
Iowa's Precious Waters
Lakes: Aging and Pollution
The Mississippi River: Ol' Man River and the Twentieth Century
Oxygen Levels during an Algal Bloom
There Once Was a River Called Missouri
Tomorrow will not Wait – Air, Water and Land Conservation
Water Pollution: A First Film
Water Pollution: Soil and Water Conservation

***Popular Literature***

Mendoza, G. 1990. Were You a Wild Duck Where Would You Go? A wild duck narrator looks at the past when the environment was bountiful, searches through today's polluted environment for a home, and encourages saving and restoring the environment for a home and for the future.

MacGill, Sheila. 1991. And Still the Turtle Watched. A turtle carved in rock on a bluff over a river by Delaware Indians long ago, watches with sadness the changes humans bring over the years.